Coastal Storms and Their Impacts: A Brief History for Delaware

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DelDOT Webcam photo, State of Delaware

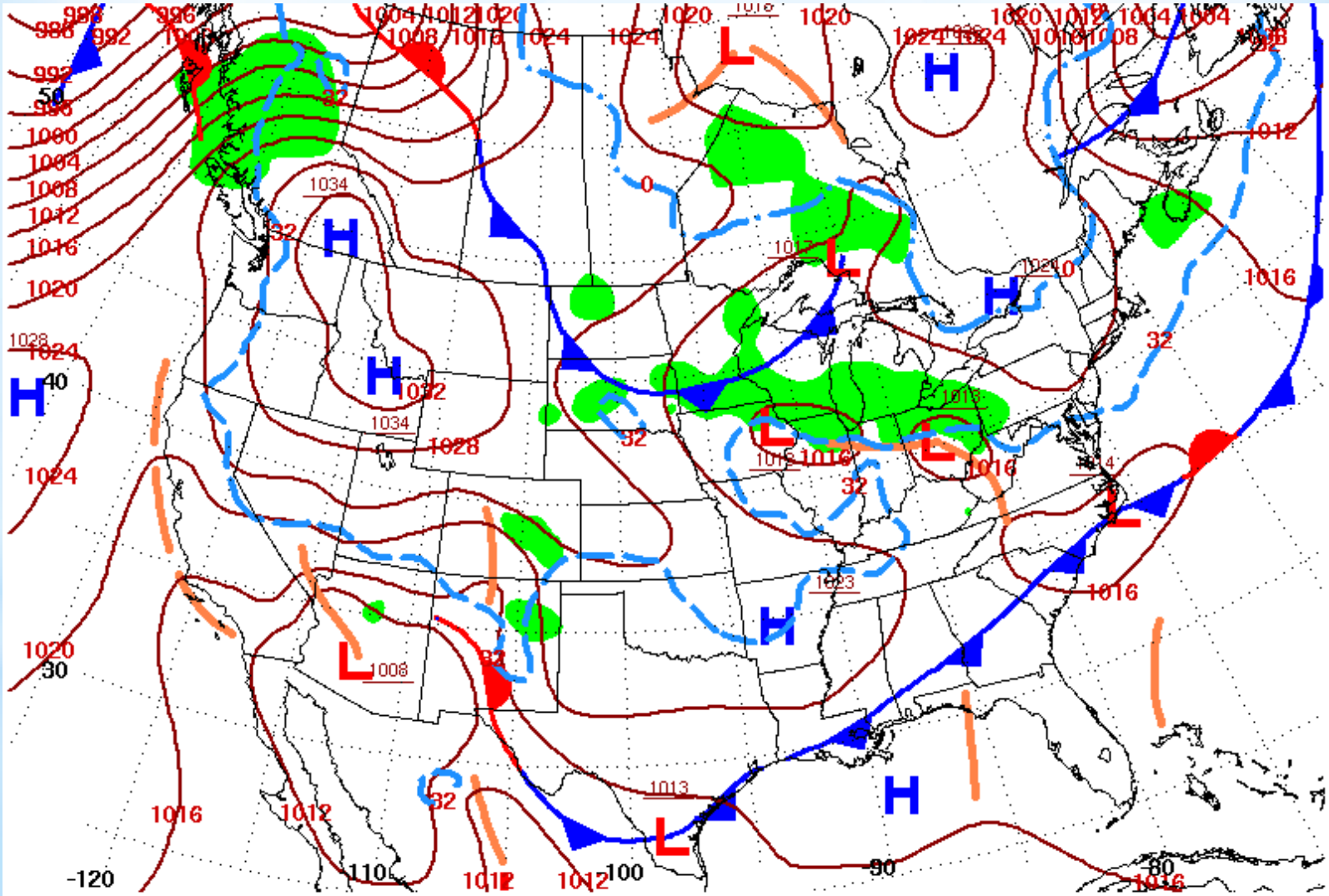
Coastal Storms are Delaware's most important weather-related hazard.

Photos:
Kevin Snyder – News Journal
Dan Leathers
Delaware Free News
Jennifer Corbett – News Journal

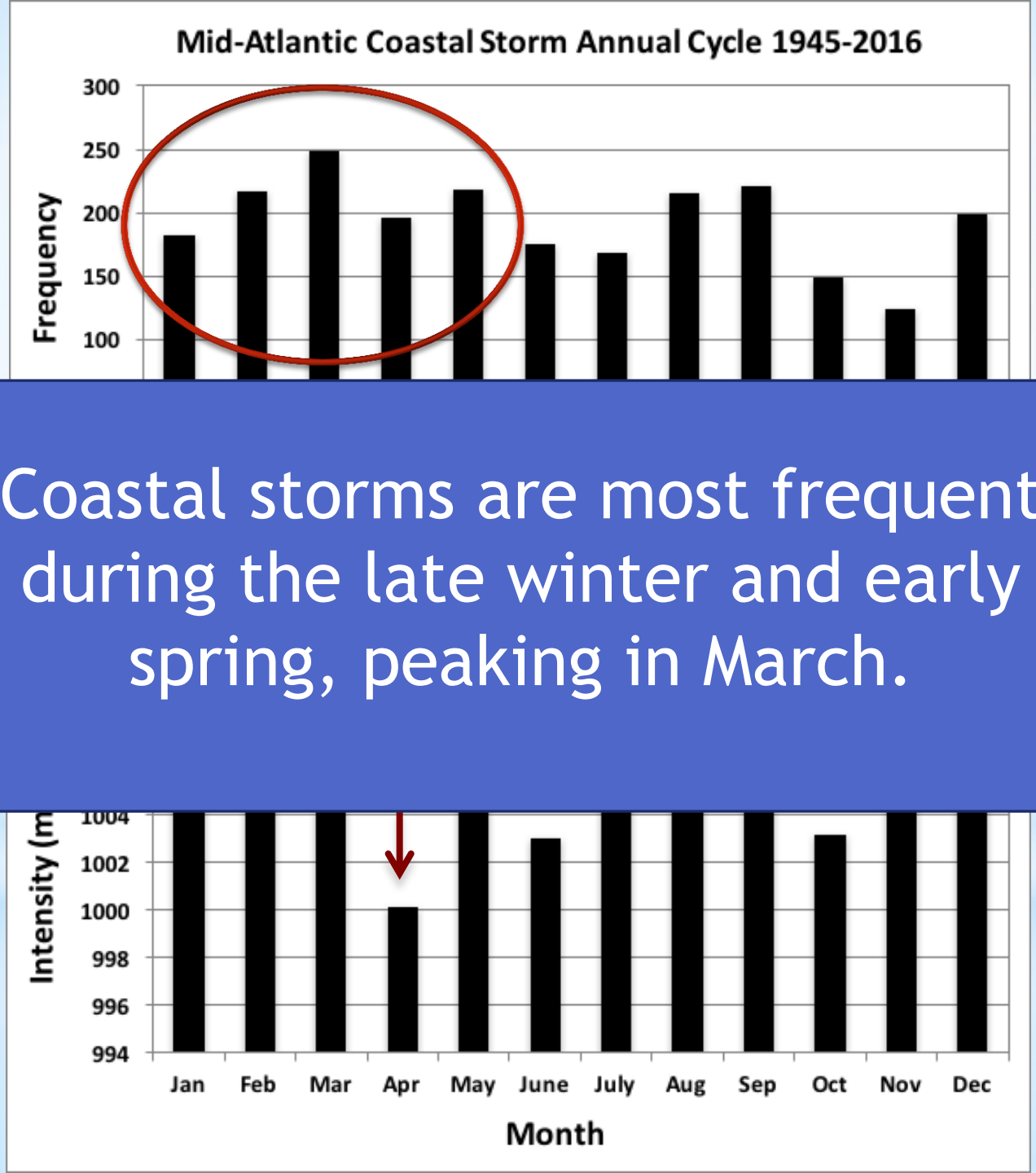
What do we know about coastal storms in the mid-Atlantic?

Both mid-latitude and tropical cyclones

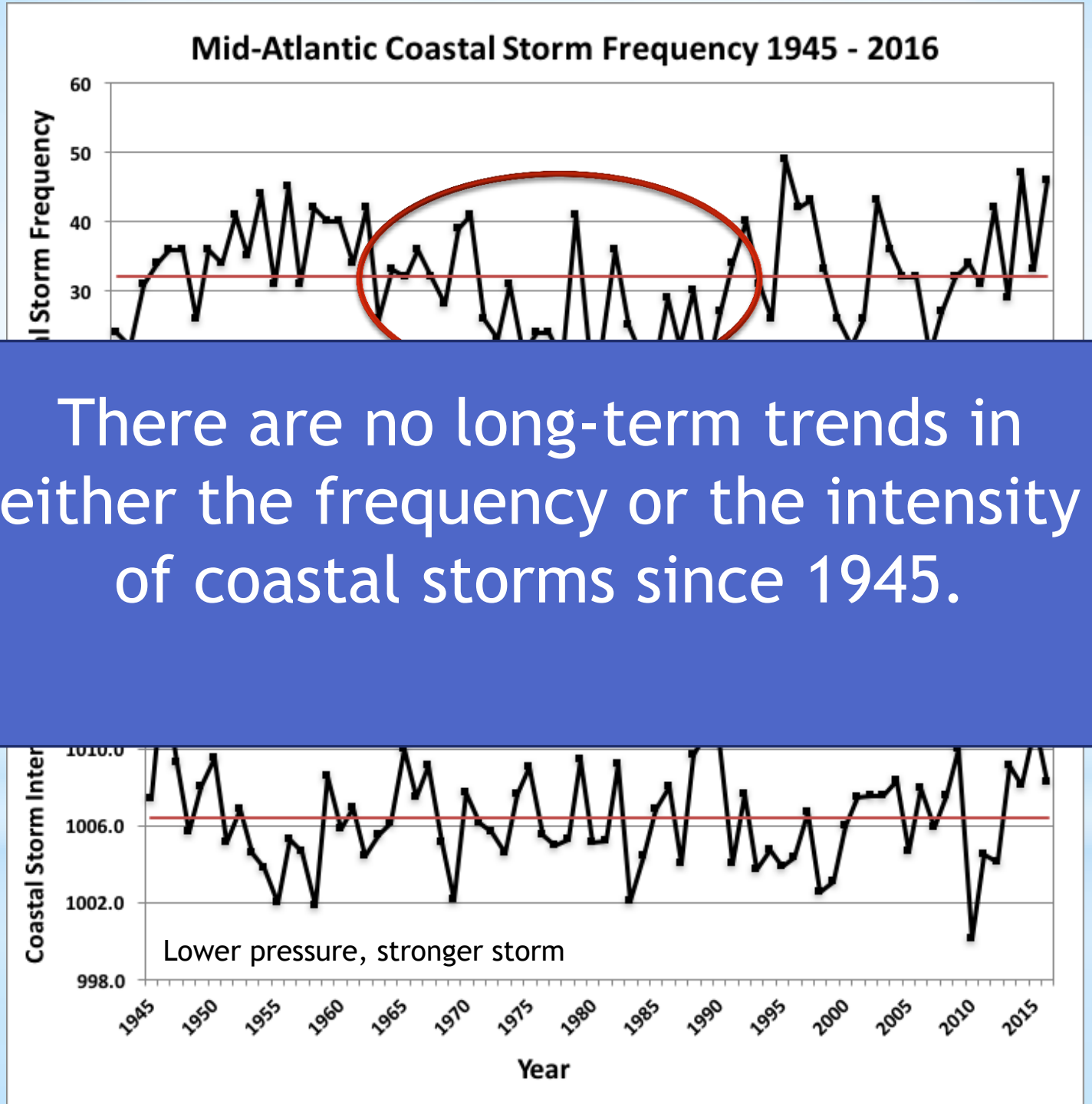
All storms (at least one closed isobar) that entered either zone were identified for the period 1945 – 2016 from manual inspection of NOAA Daily Weather Maps. Storm type (tropical or mid-latitude), sea-level pressure, and zone of occurrence were recorded. More than 26,000 maps were analyzed by graduate and undergraduate students.



Surface Weather Map at 7:00 A.M. E.S.T.



Coastal storms are most frequent during the late winter and early spring, peaking in March.

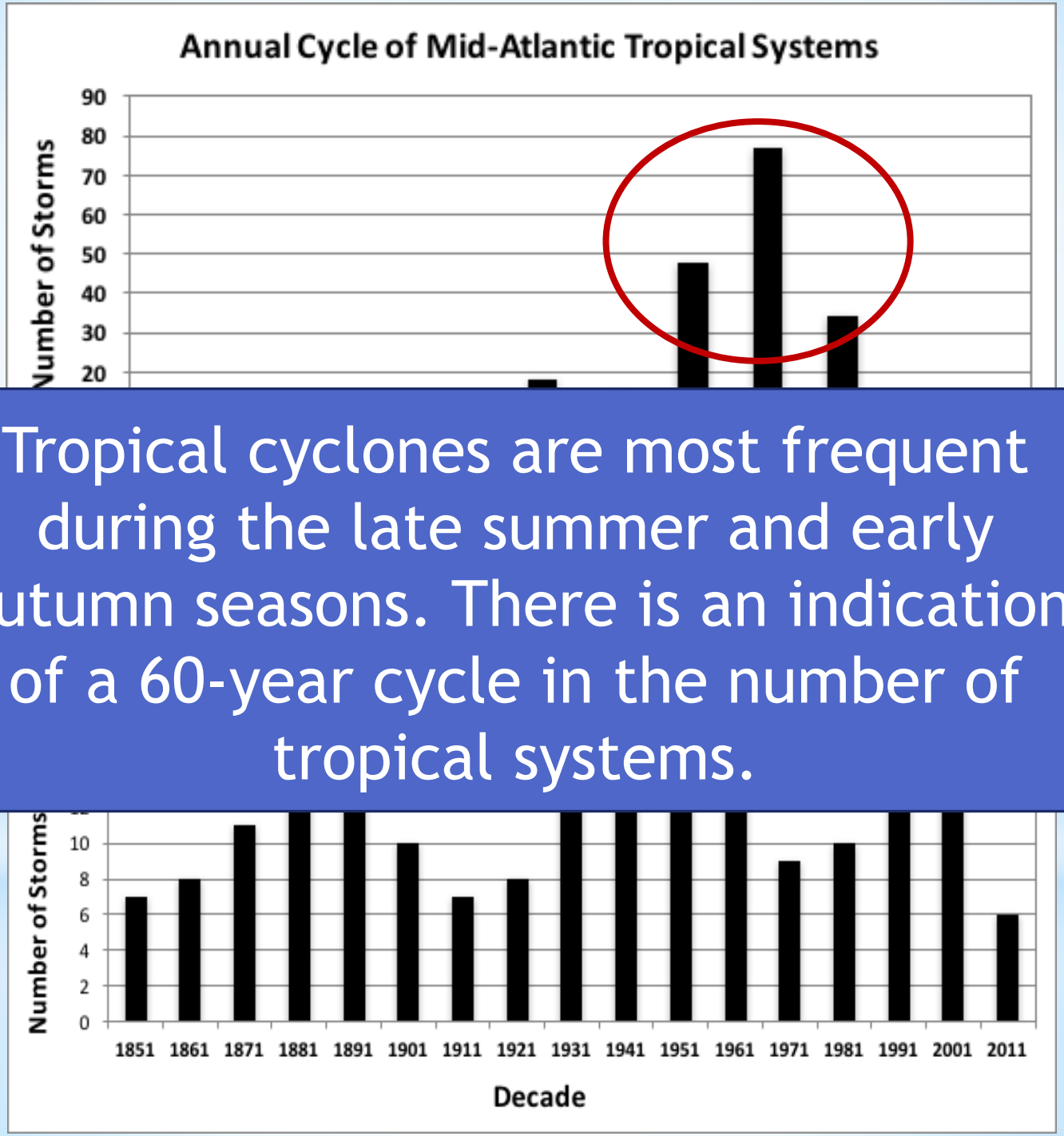


There are no long-term trends in either the frequency or the intensity of coastal storms since 1945.

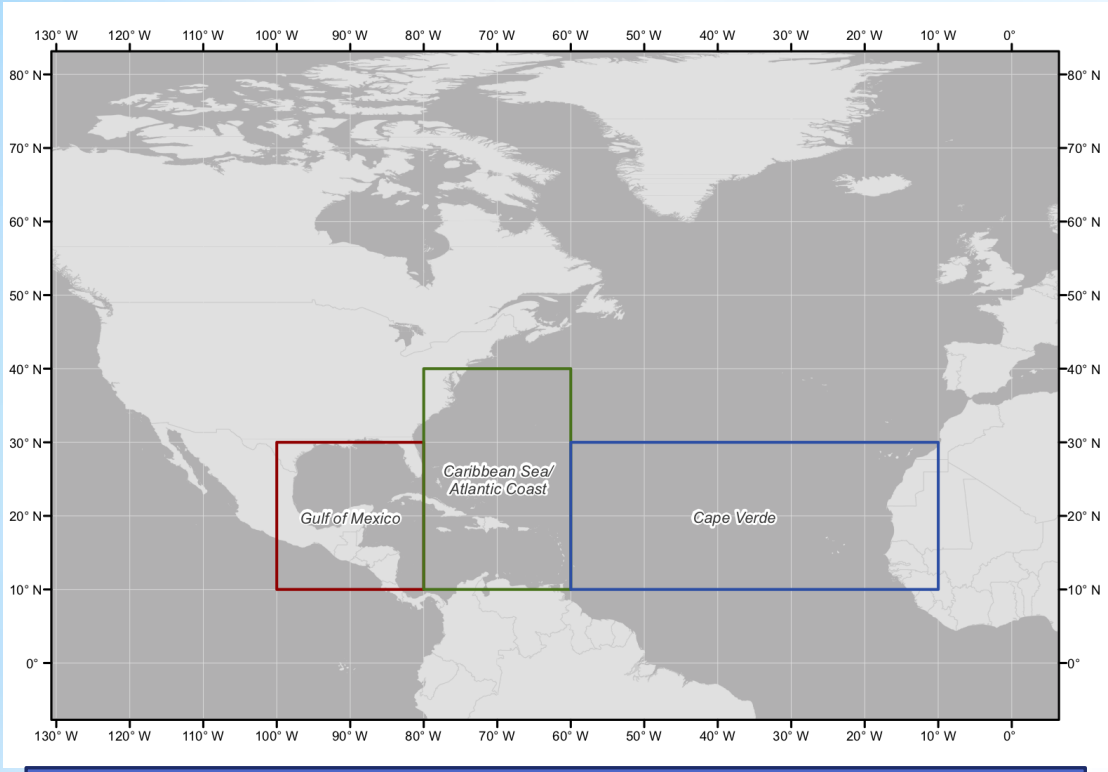
What do we know about tropical cyclones affecting the mid-Atlantic?

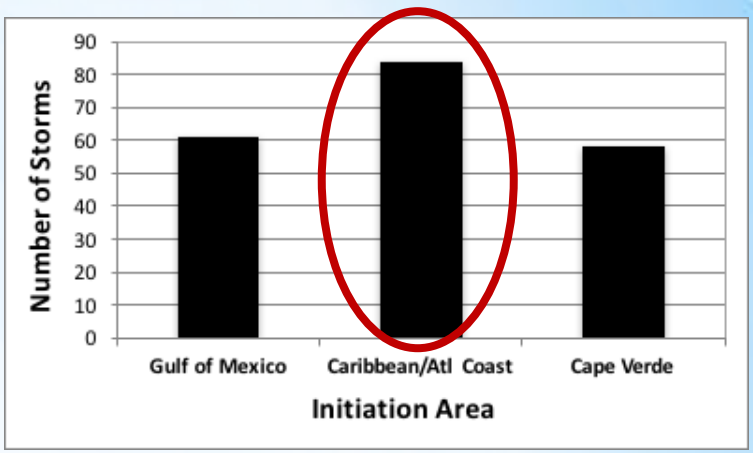
All tropical systems that passed within 200 miles of Lewes, DE (the Mid-Atlantic Region) were extracted from the IBTrACS (International Best Track Archive for Climate Stewardship) data set for Analysis.

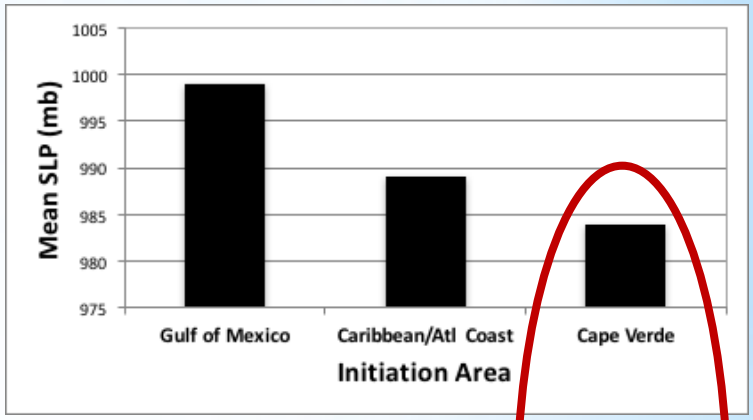
203 cyclones have passed through this area during the period 1851-2016.

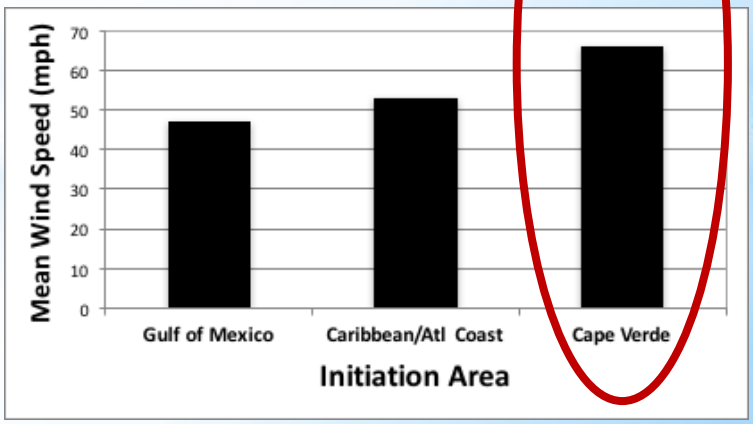


Tropical cyclones are most frequent during the late summer and early autumn seasons. There is an indication of a 60-year cycle in the number of tropical systems.



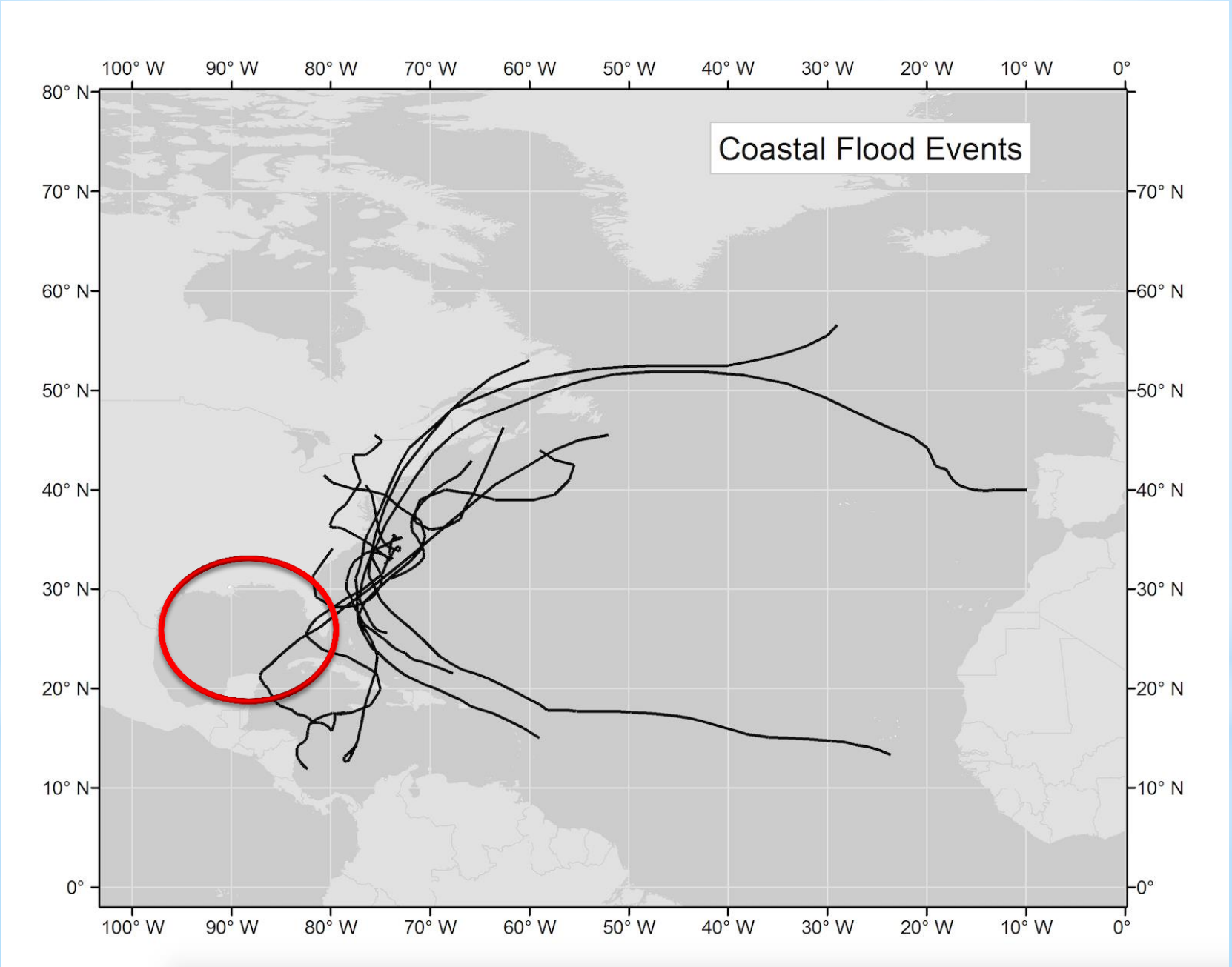






Cape Verde storms reach the Mid-Atlantic with the greatest intensity.

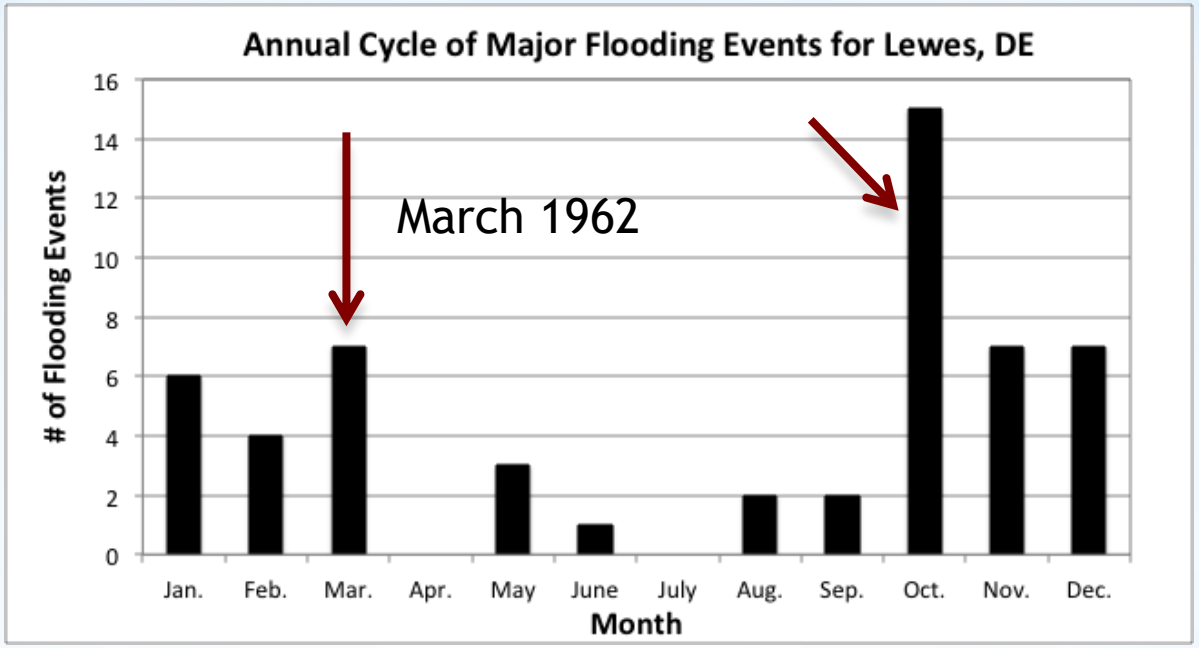
Tracks of Tropical Systems Associated with Major Coastal Flooding in the Mid-Atlantic

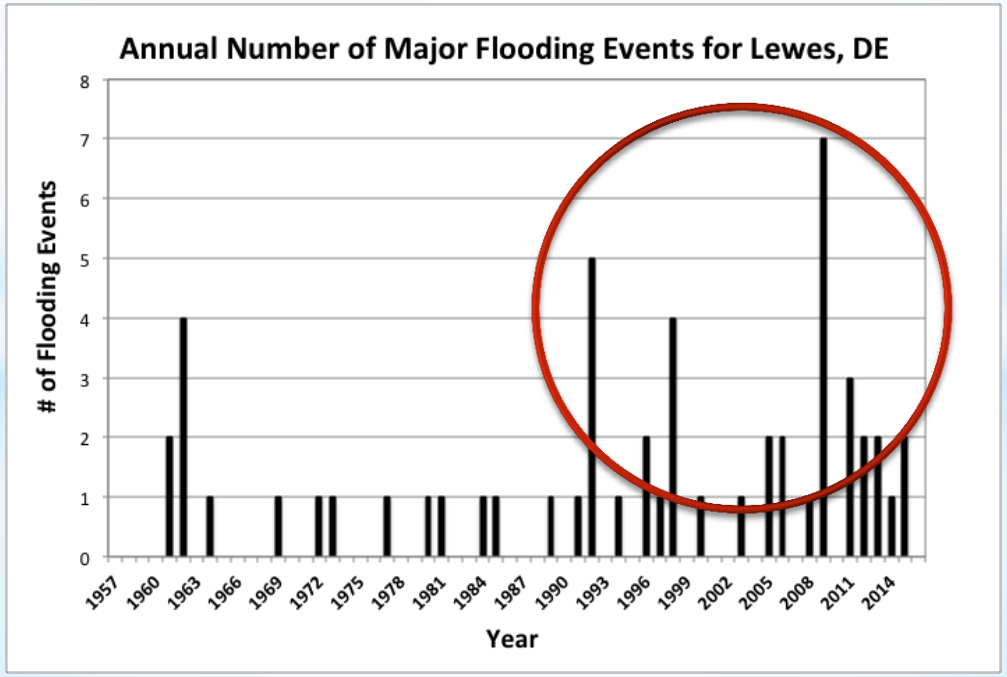


There have been 36 moderate coastal flooding events and 6 severe coastal flooding events since 1957 at the Lewes, DE tide gage.

Of the 42 events, 37 have been associated with mid-latitude cyclones and 5 with tropical weather systems.

Storms are Important to Major Coastal Flooding!!


Annual Cycle of Major Flooding Events for Lewes, DE
# of Flooding Events
16
14
12
10
8
6
4
2
0
March 1962
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
Month


Annual Number of Major Flooding Events for Lewes, DE
# of Flooding Events
8
7
6
5
4
3
2
1
0
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
Year

Summary…

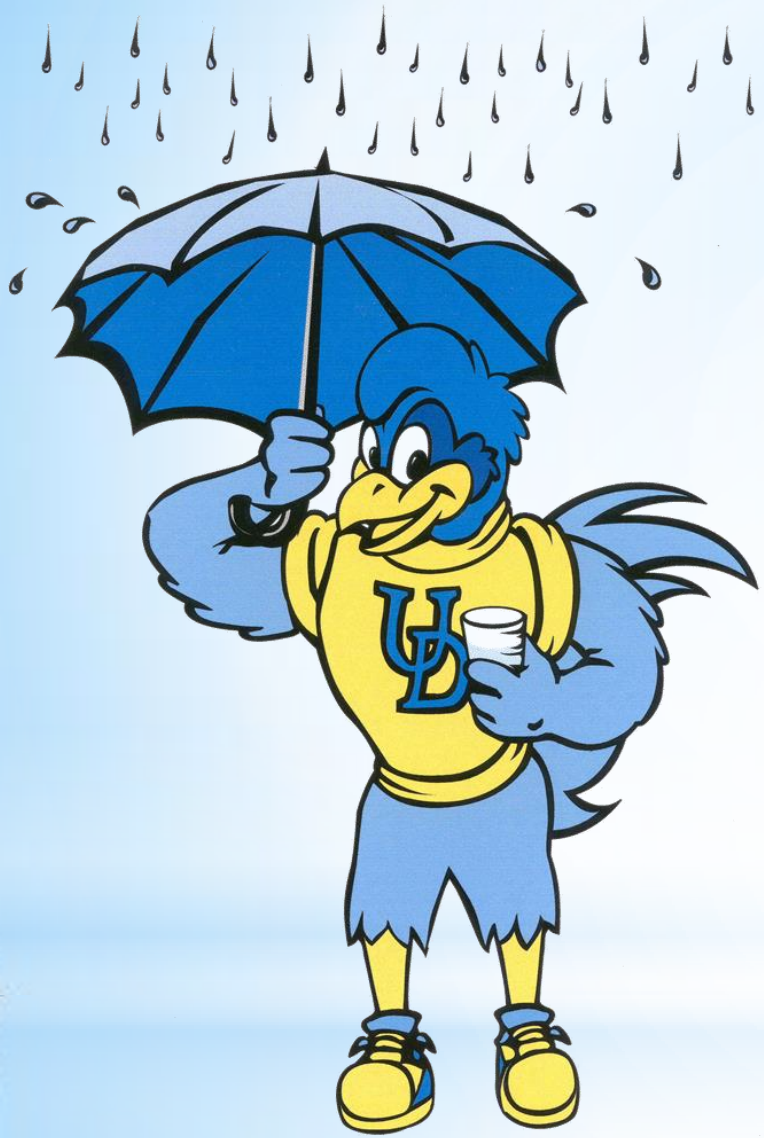
- Coastal storms can impact the entire state of Delaware with coastal flooding, high winds, heavy rain, and in winter heavy snowfall.
- Coastal storms are most frequent in the late winter and early spring, peaking in March.
- There have been no long-term trends in either the frequency or intensity of coastal storms since 1945.
- Tropical cyclones are most frequent in the late summer and early autumn seasons, and there is indication of a 60-year cycle in the number of storms.
- Tropical systems originating in the Cape Verde development region, off the African coast, reach Delaware with the greatest intensity.

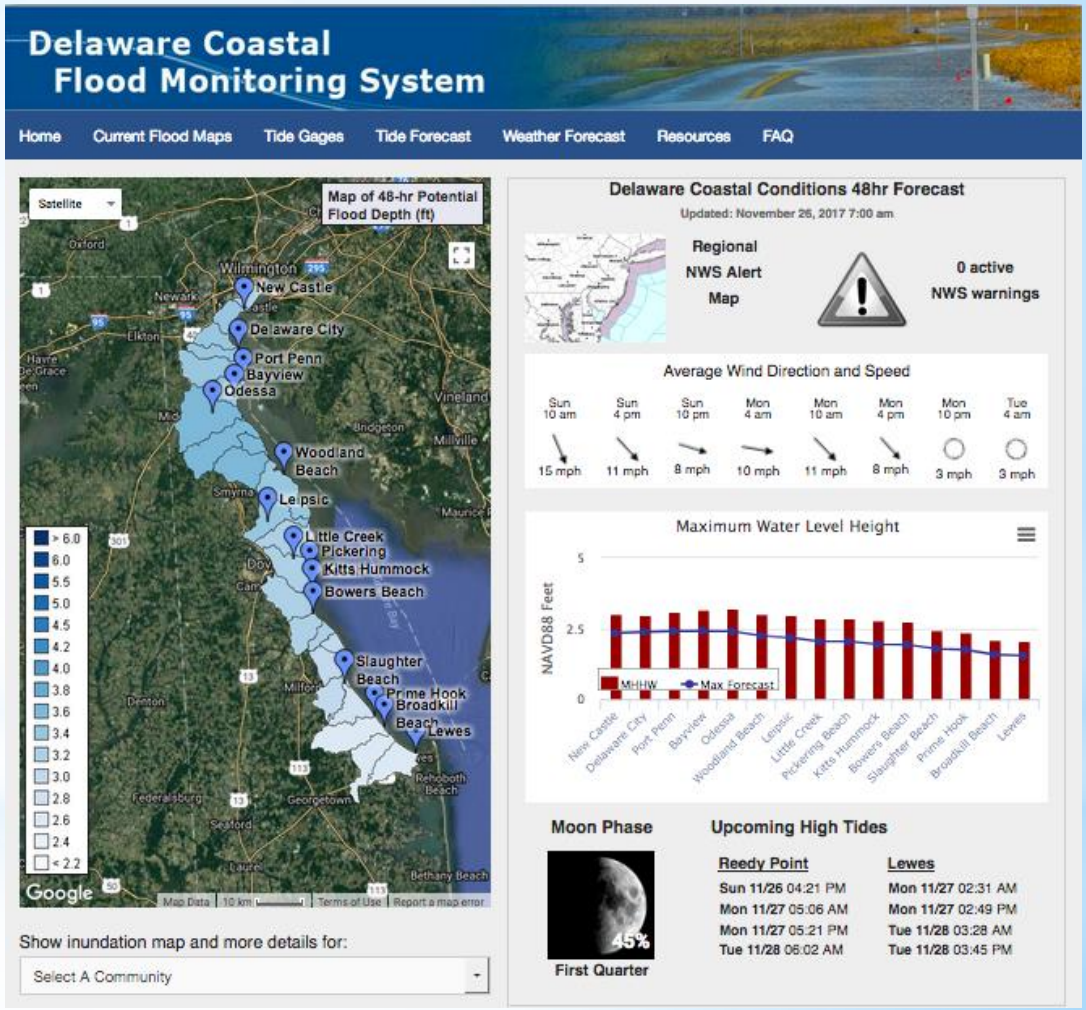
A Big Question…

Although the number of major coastal flooding events have increased in recent decades, there has been no increase in the frequency, or intensity of coastal storms in the Mid-Atlantic.

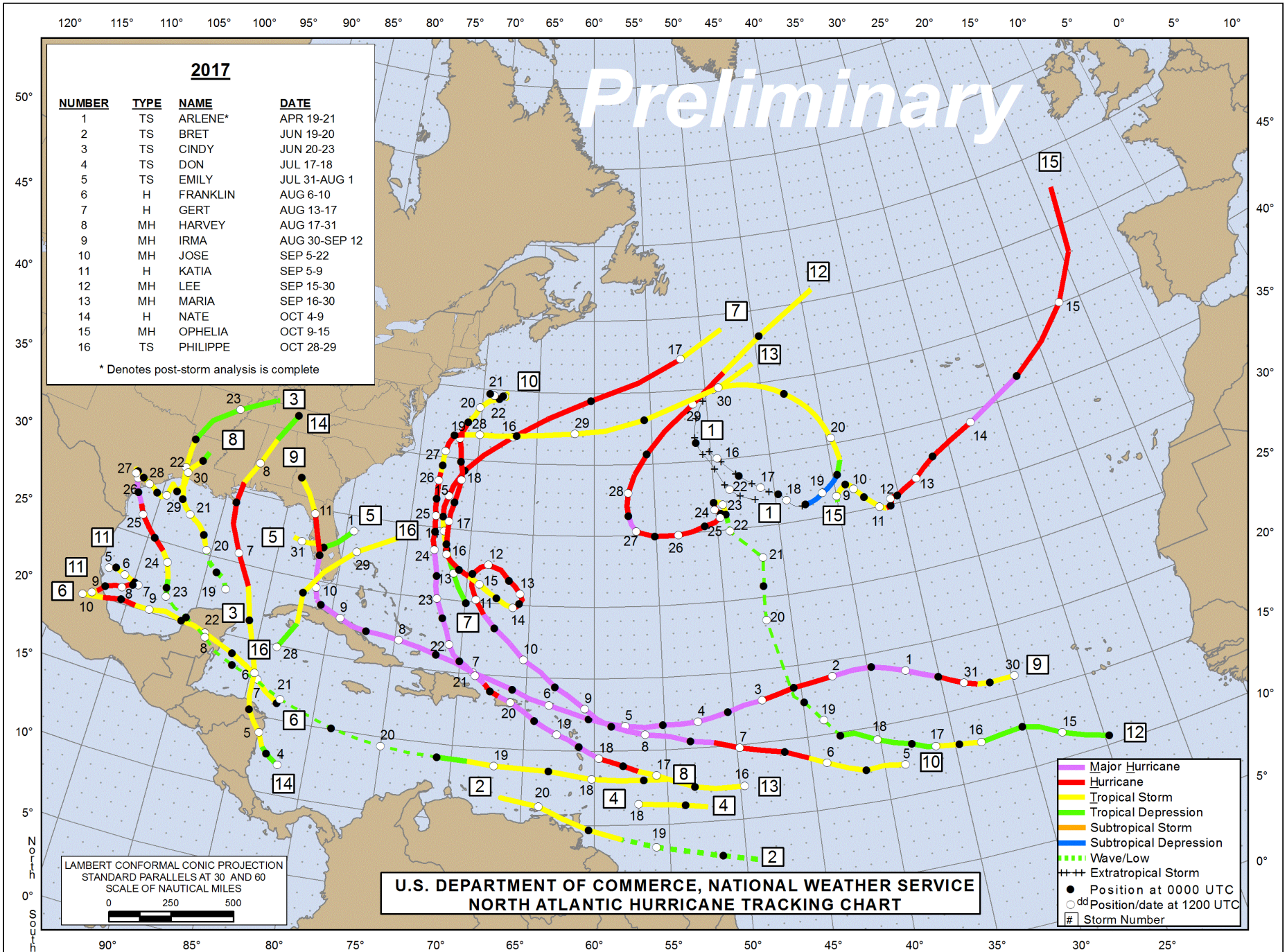
What are the reasons for the increase in major flooding events?

Questions or Comments?

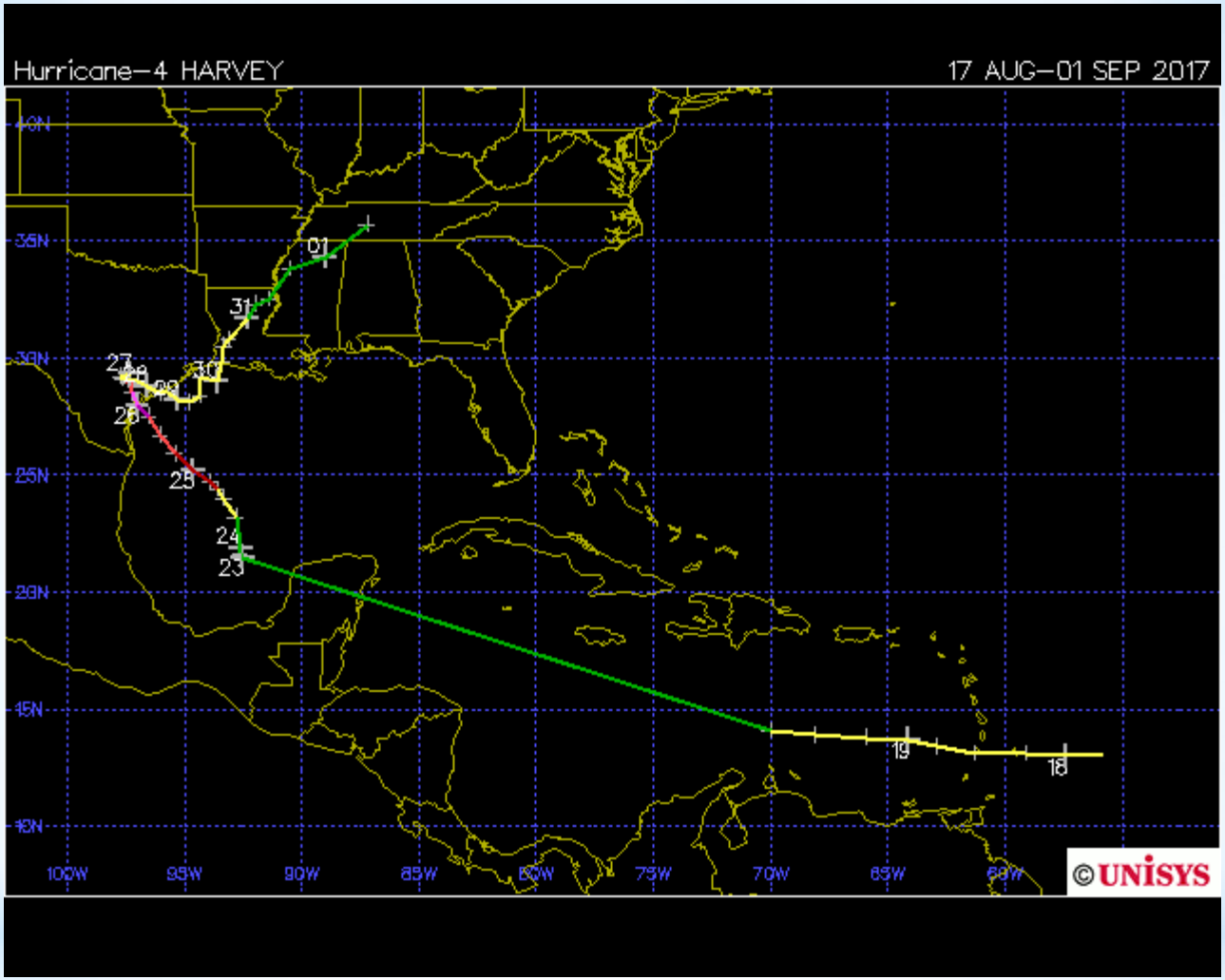




coastal-flood.udel.edu/

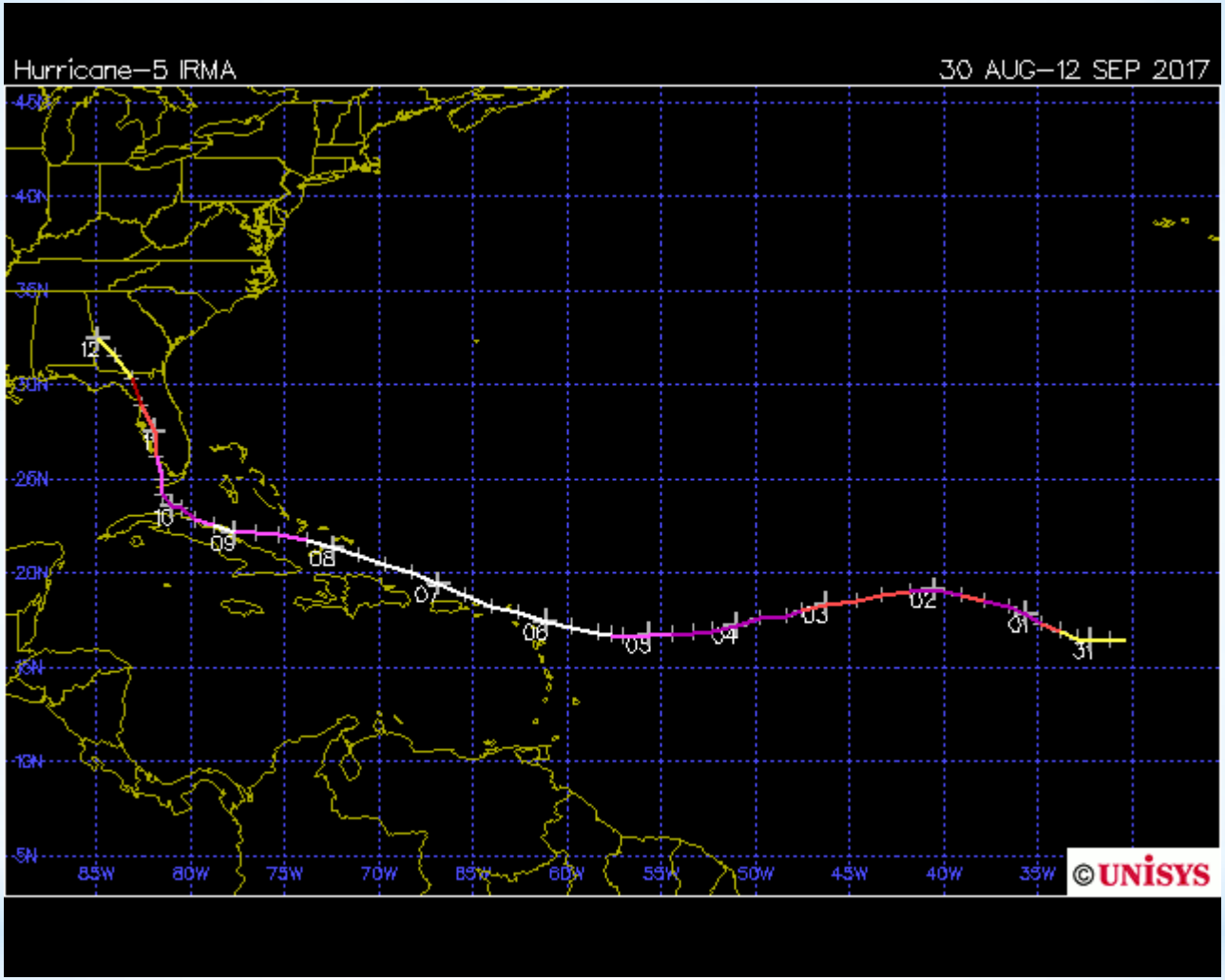

2017
NUMBER TYPE NAME DATE
1 TS ARLENE* APR 19-21
2 TS BRET JUN 19-20
3 TS CINDY JUN 20-23
4 TS DON JUL 17-18
5 TS EMILY JUL 31-AUG 1
6 H FRANKLIN AUG 6-10
7 H GERT AUG 13-17
8 MH HARVEY AUG 17-31
9 MH IRMA AUG 30-SEP 12
10 MH JOSE SEP 5-22
11 H KATIA SEP 5-9
12 MH LEE SEP 15-30
13 MH MARIA SEP 16-30
14 H NATE OCT 4-9
15 MH OPHELIA OCT 9-15
16 TS PHILIPPE OCT 28-29
* Denotes post-storm analysis is complete
Preliminary
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30 AND 60
SCALE OF NAUTICAL MILES
0 250 500
U.S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
Major Hurricane
Hurricane
Tropical Storm
Tropical Depression
Subtropical Storm
Subtropical Depression
Wave/Low
Extratropical Storm
Position at 0000 UTC
dd Position/date at 1200 UTC
Storm Number

Seasonal statistics	
Total depressions	18
Total storms	17
Hurricanes	10
Major hurricanes (Cat. 3+)	6
Total fatalities	464 total
Total damage	≥ $316.51 billion (2017 USD) (Costliest tropical cyclone season on record)



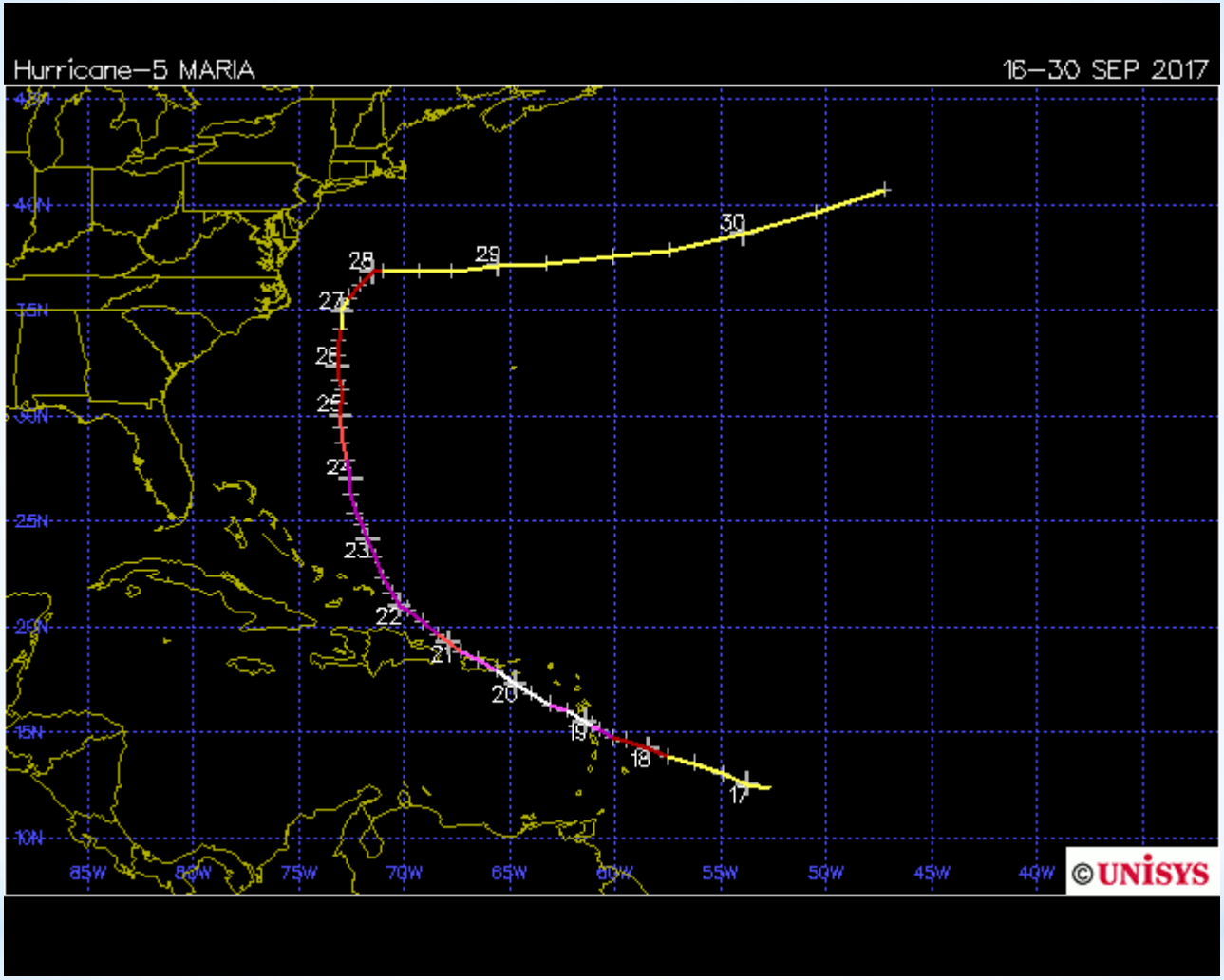
- **Hurricane-4 HARVEY** (17 AUG-01 SEP)

  Storm - Max Winds: 115 Min Pres: 938 Category: 4



- **Hurricane-5 IRMA** (30 AUG-12 SEP)

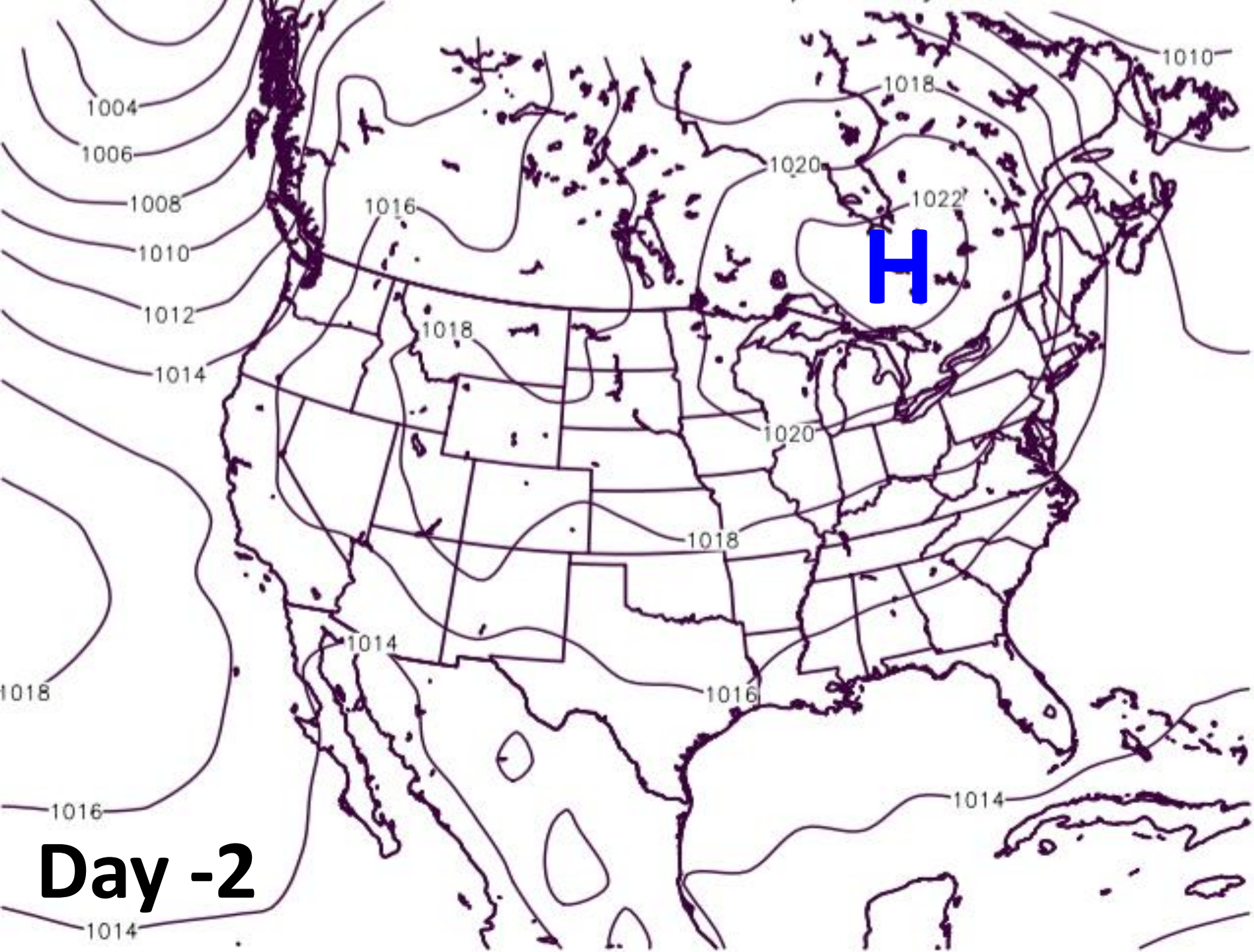
  Storm - Max Winds: 160 Min Pres: 914 Category: 5



- **Hurricane-5 MARIA** (16-30 SEP)

  Storm - Max Winds: 150 Min Pres: 909 Category: 5

Construct atmospheric composites of 42 major coastal flooding events associated with mid-latitude storms.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1006
1008
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1012
1014
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1016
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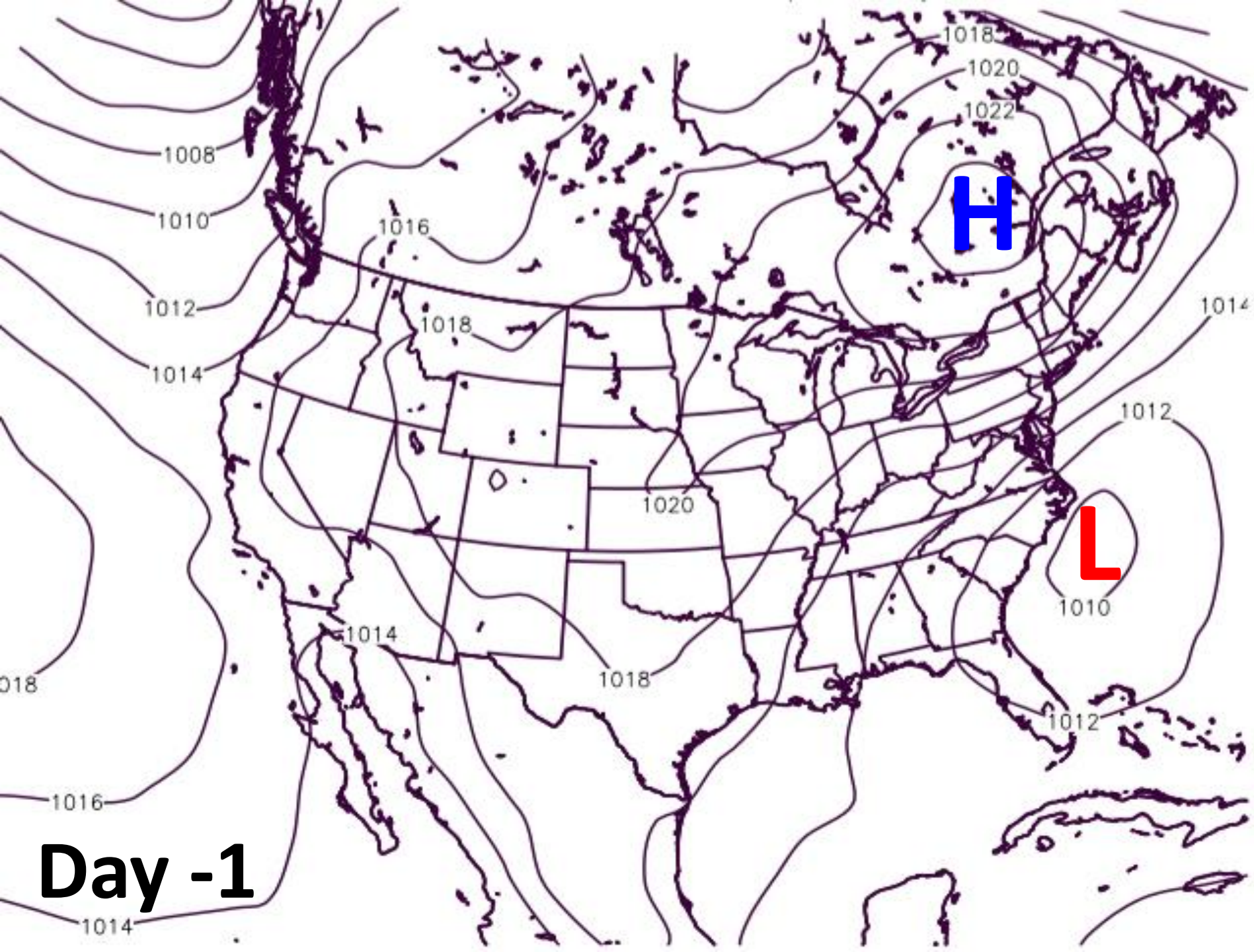
1014
H
Day -2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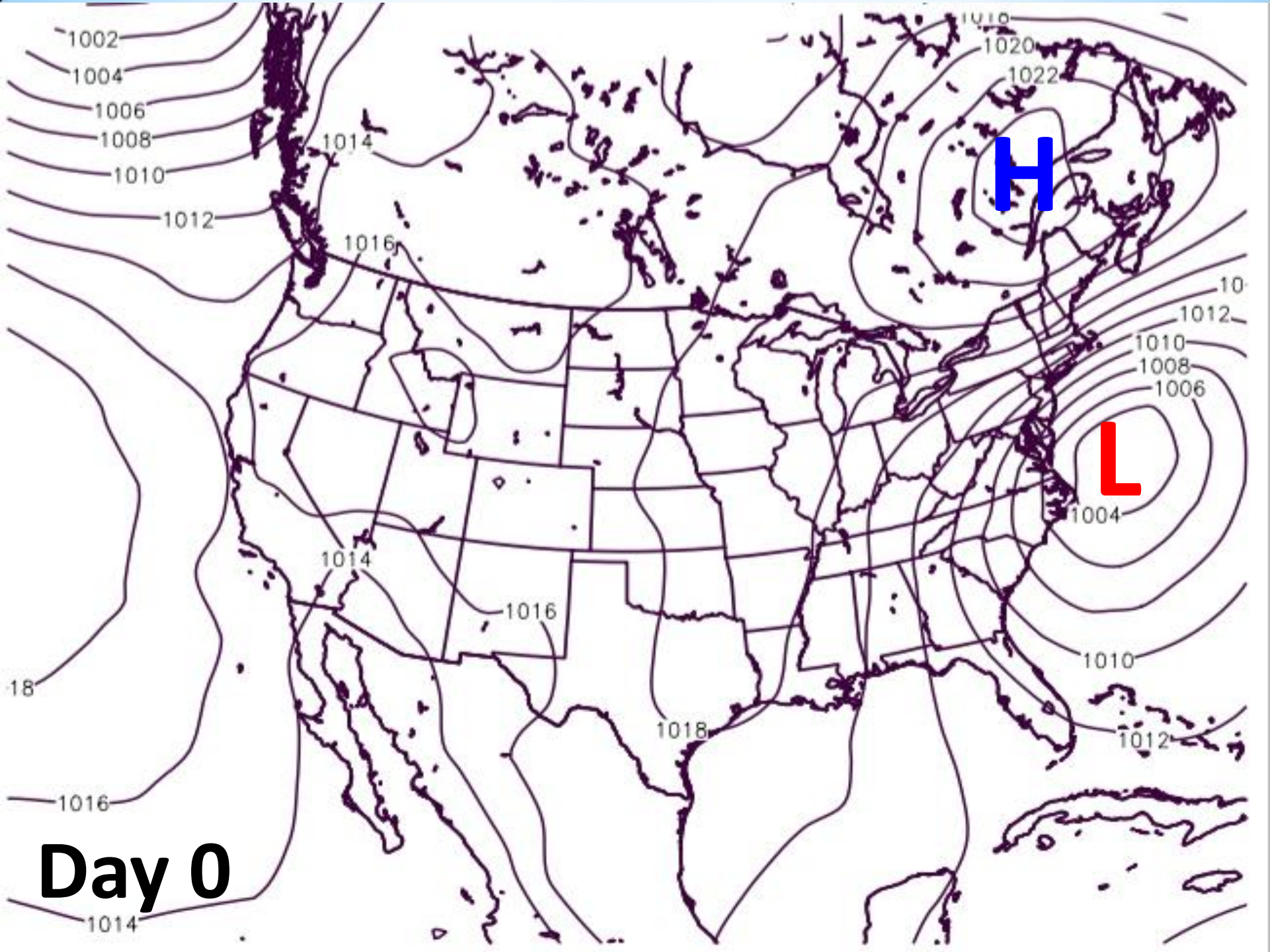
1014

Day -1


1002
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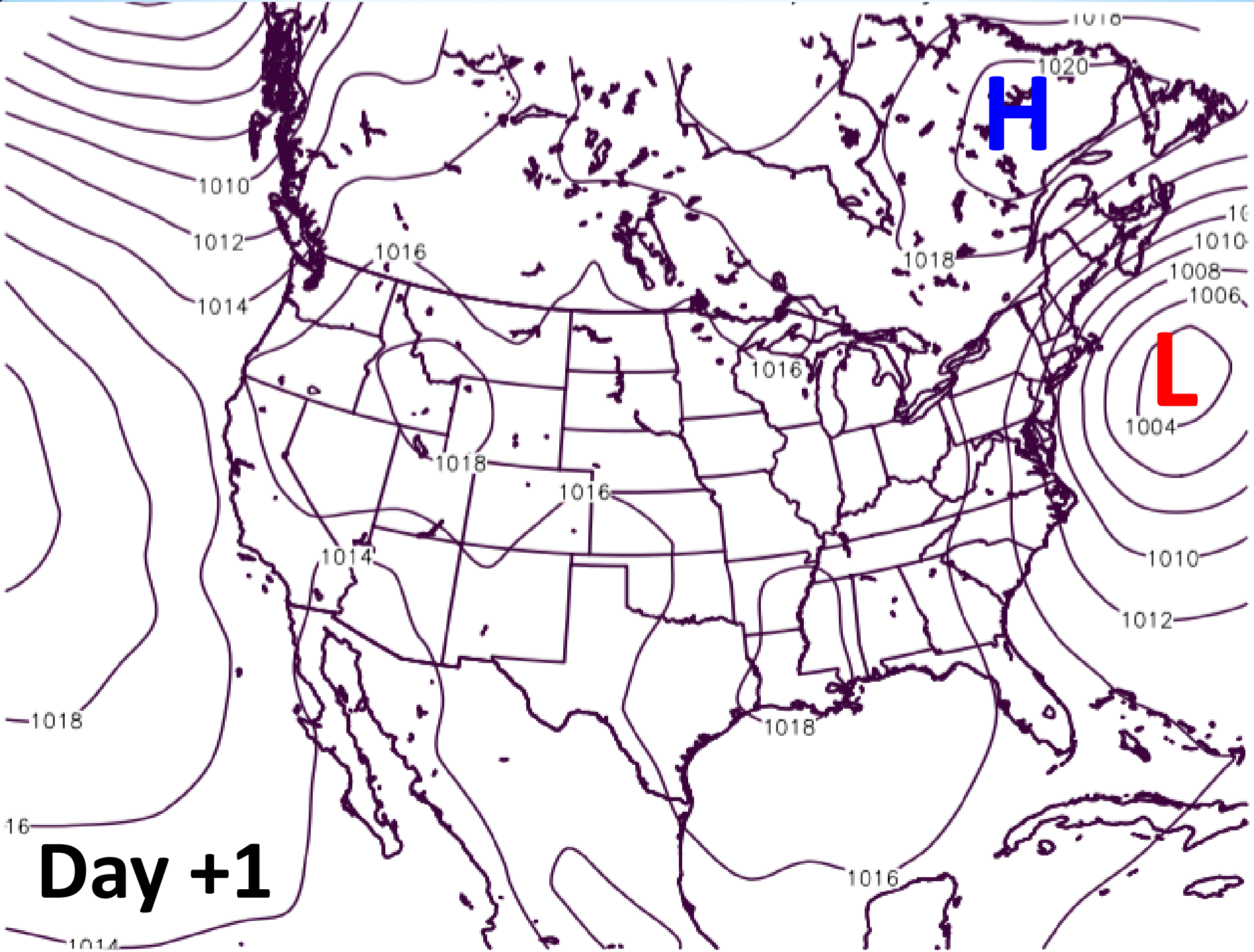
Day 0


1020
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1018
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1006
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1012
1018
1018
16
1016
1014
Day +1